PYROTECHNICS

THE NOW & THEN NEWSLETTER OF
GENERAL TECHNICS

PERPETRATED LARGELY BY
JEFF DUNTEMANN
& MIKE O'BRIEN

GENERAL TECHNICS

NO. 7 MAY 1977

CALL HIM JOE!

It started a long time ago, probably before most of us ever realized that people did more with science fiction than read it. George Ewing and Dave Hoornstra, hobnobbing in Harvey's basement, decided it would be nifty to have a thing carry their beer around for them at conventions and other gatherings where 807's would be in great demand. Ewing thought one of those battery-powered floor squeegeers might be had on the surplus market and blessed with remote control. Dave thought that was being ambitious, especially considering the juice those things gobble, so he suggested filling the Lawson Torpedo he had in the basement with technology and letting it do the work.

Ewing cobbled together a squarish plywood frame and came up with a couple of tired out windshield wiper motors, and managed to make the can roll around for a few hours on a charge. They started to install a Sixer for remote control purposes, but got only about that far. In time, the Torpedo and the motors began to gather dust at the Sault Ste. Marie Ewing HQ.

And so it stood until Chambanacon, when the Lawson Topedo rose once more from the depths of memory at the GT meeting in Steve Johnson's LED cluttered hotel room. George put forth the idea that the robot be resurrected and completed with modern IC technology. Instantly somebody suggested PLL's and and microprocessor and memory and artificial intellegence and TV eyes and...

The Joe Project was off to a creaking start.

ConFusion saw the delivery of the motors and the torpedo. The can was rusty and one of the motors went on strike during testing. Kurt Sakaeda buffed and repainted the torpedo a soft tan, and also came up with a couple of motors out of the window wells of an old Cadillac. These motors were new, faster, and reversable. Needless to say, they haven't been installed yet.

The old motor came back to life during the week before Marcon. Steve and Tullio worked like unholy devils for an entire week in the dungeons of the DePaul University Physics Dept. putting the creature together. Once in a while they slept, and it is rumored (but far from certain) that they ate lunch once. Still, on the morning before Marcon, Joe rolled out of the lab and into Steve's trunk.

Joe's Mark I configuration was a masterpiece of klugework. One of my 1964 Space Patrol walkie-squawkies was strapped beneath the beer cooler platform, hooked to a wire from the CB loaded whip mounted atop his Commando Cody crown. Output from the talkie went to a quickly wire-wrapped pair of 567 tone decoders. One of these decoded a TouchTone row, the other a TouchTone column. One of the decoders controlled each motor. If you pushed the TT button where the decoded row and column intersected, both motors went on, and Joe rolled happily forward. If you pushed one of the other buttons in the row or the column, Joe would turn right or left, depending on which motor you energized.

(By the way, in case any of this goes by you, pull out Pyro #3 and read up on the TouchTone system. No techie can afford not to understand it. Copies can be had from...guess who?)

The control box was hastily-crafted black plexiglas, containing a Western Electric TT pad and Steve's Pocket Com microminiature CB talkie. To operate Joe, you simply pushed transmit on the Pocket Com and pressed the desired button. Off he went, into convention history.

Joe was, of course, the center of attention at the convention. There was nothing else like him there, and very little that could possibly compete with an honest-to-god robot, except perhaps free beer or naked women, of which there was little and few.

Radio control range was about sixty feet or so. Tullio's Pinto car battery, which was Joe's sole power source, was a little pooped even before the con started. Joe was thus never terribly perky, but he stole the show nevertheless. Steve ran him into the cheap little bar at the hotel, danced him around for a few moments until a few drunks screamed and/or wet their pants, and then rolled him out again. Close to the bar's exit was another Lawson Torpedo, this one less ambulatory and more committed to picking up trash. Steve expertly stopped next to the trashcan, made Joe do a double-take, and then coyly rub up against the other can's side. The trashcan was unimpressed, but the bartender went into hysterics.

After Marcon Steve picked up a battery charger, and from then on Joe traveled twice as fast and quite a bit farther. A week later we rolled him down the street to the Dunkin Donuts near my place, and had him ask the girl for a dozen donuts. Steve had to do the asking, of course, but it made us doubly determined to get Joe a voice as soon as possible. On the way home Joe hit a chuckhole in our marvelous Chicago sidewalk, and pitched over on his side. Kurt's paint job took a beating, but after Phil Phoglio righted him he was no worse for the wear. Steve, Carol and I, Gus and Kathy, Jim Fuerstenberg, Mike O'Brien and Sarah Shaw all got a chance to run him around.

Joe is now in a million pieces again, awaiting new motors and binary-decoded motor controls. The motor controllers will have a 555 oscillator and a number of gates. These will respond to a 2 bit code input with four possible modes: Stop, half-forward, full-forward, and half-reverse. These controllers will make microprocessor control possible, certainly by SunCon and possibly much sooner than that.

For the future? This is what we've tossed around: linking by radio to Steve's Zilog system. A radio-controlled arm, probably of polished plexiglas studded with LED's. Room memory, recalling the direction and magnitude of turns and distance travelled between them. Voice, with two intriguing possibilities. Dave Corner says we can rig a speech characteristic modifier with active filters to change any of our voices into a uniquely "robotic" voice which could be stored on tape or generated from radio transmitted input. The second possibility is even stranger: generated voice directly using the system described in the current Popular Electronics. My own little microprocessor might not to able to handle it, but Steve's Zilog certainly could, and radio linking is no tremendous problem.

GENERAL TECHNICS is an organization of fannish techies (and not techish fannies, as some wiseass reported) who share data, resources, and experienc in pursuit of a good time and occasional profit. The group meets mainly at cons, hamfests, and private Berserker Weekends.

MEMBERSHIP is terribly difficult to obtain. You must somehow scrape up a number of 13¢ stamps, and then at great effort write a letter explaining what your qualifications as a techie are to

Jeff Duntemann
6424 N. Albany Avenue
Chicago Illinois, 60645

including those stamps. If the above person can read your handwriting you are an

APPRENTICE TECHIE and entitled to call yourself a member of General Technics. You will also receive

PYROTECHNICS until your stamps run out. Renewal of membership is synonymous with sending more stamps. If you decide to quit, we will use one of your stamps to send the rest back to you. If you're nuts enough to want to become a

SECRET MASTER UV TECHNOLOGY (SMUT) you had better talk to

Tullio Proni
1309 Wells Place
Kalamazoo Michigan, 49001

because I don't have anything to do with it.

ANYTHING ELSE, ask me. I may not know but I'll tell you anyway.

Those of you who will be at SunCon will certainly see the most spectacular gizmo ever to hit a worldcon, or any con for that matter. See Joe. See Joe run. See him run up to Isaac Asimov, screaming, "Daddy! Daddy!" See him order Harlan Ellison to stand up and fight like a man. See him enter the Masquerade as a human being. You'll see plenty. Watch these pages for the latest on the shitcan with a brain!

QUARKS

Gus Flassig and Kathy Echterling coupled their oscillators for a lifetime of in-phase operation on April 9th. Steve Johnson, Dave Corner, and I were the GT people in the wedding party. Not much tech was talked at the reception, but the mechanics of Polka dancing were studied with a great deal of enthusiasm. Steve caught the garter. Enjoy it while you can, Steve.

Gus now works at Lillipute Computer Mart, as general technician and whatnot.

Gordon Garb recently bought a nice little modem for forty bucks, reversed the power leads, and promptly blew out the IC's. After replacing the IC's he fired it up again, only this time connecting the power and ground wires between +12V and -12V. The third set of IC's is about to go in... [Are you sure turing started this way?]

Your editor breathed life into his homebrew wirewrapped CDP1802 computer system, affectionately known as COSMO Klein, April 17. He demonstrated it to his wife by executing a 6 byte test program that pulled one of the output lines high and turned on an LED when an input switch was operated. "Look, Luv, when I hit this switch a light comes on!" he said to his wife. Wife replied, "You mean it takes a computer to turn on a light? Isn't that shooting flies with a howitzer?"

Mike O'Brien is currently in California (though he'll certainly be back by the time you read this) hunting for a job. Next February let's all get together and send him a few megaflakes of Chicago frosting so he won't get lonely, OK?

Your editor sold a story, "Inevitability Sphere," to Isaac Asimov's Science Fiction Magazine for 170 bucks, his first fiction sale in 2 years. No publication date is given. Guess you'll have to buy them all...

The Santa Fe Hamfest is June 12th, and it's not too early to start thinking about it. Steve, poor soul, is graduating college that day and will not be attending. Any other locals or near-locals who want to get in on one of the biggest techie picnics of the year, get hold of me and we'll start making arrangements.

George Ewing appears in print in the May issue of CQ Magazine, with an article entitled: "I am Curious, Infrared." It's about all the neat things you can do with non-xerographic (wretch) copy machines, like make pc board silk screens, etc etc with lots of practical information on various photosensitive copy materials. Get it at big newsstands, and note the picture of WA8WTE feeding a document into a hungry thermofrig machine. Reminds me of the time some woman fed a cheese sandwich into a 2400 duplicator...

Latebreaking Joe news: the much-touted new motors don't work. Regardless of the fact that they suck 10 amps apiece out of our poor battery, you can stop them with your fingers. Needless to say, they won't pull Joe's bulk. Back to the drawing board.

I still have plenty of back issues of PT #3 to date. #2 & 1, alas, belong to the ages, but I can make second-gen copies on a special order basis for those of you who really wanthem. Drop me a note and tell me which you need, and I'll mail them out to you pronto.

We are all out of General Technics T-shirt iron on transfers. If anyone wants them yet, contact Bob Halloran and give him your order. Apparently we can get more made if enough people really want them.

VOLUME 1, NUMBER 1

Old magazines never die; they just smell that way.

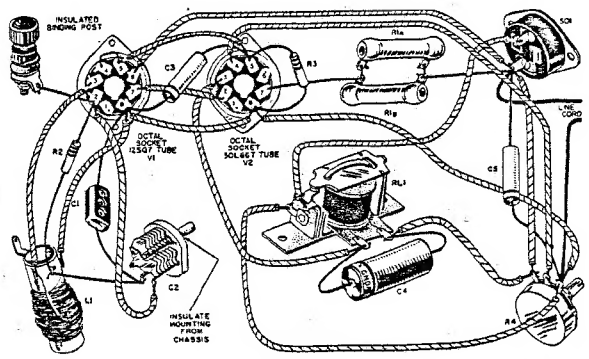
Last year at a hamfest I paid a guy five bucks for about forty pounds of old magazines, all neatly bundled and most somewhat dryrotted. He had bought them from another guy at another hamfest and never even got around to unbundling them. Later, at home, feeling like an archeologist probing King Tut's tomb, I uncovered Popular Electronics, Volume I, Number 1.

The date was October, 1954. The cover showed a crew-cut type sitting at his workbench poking probes into a Heathkit something-or-other which probably didn't work. Between the worm-chewed covers was the birth of a new hobby.

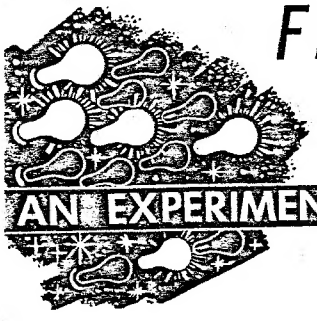
Popular Mechanics was for the circular saw and bench lathe set. QST and Radio were for ham radio ops. Up until that time, if you played with electronics you were a radio ham, no two ways about it. Postwar US affluence had created a whole new consumer field out of 6V6 power amp tubes. It was affectionately called HiFi, and from that point on, PE was its magazine.

HiFi lost its stranglehold on PE in the mid-sixties, about when the first clumsy IC's appeared. Up until that time it was a naive, folksy, down-home tinkerer's rag for the WWII vet in the basement of his suburban castle, and for the crop of curious baby-boom boys he was raising. (At that time girls just sat and listened to HiFi sets; god forbid she should break a ruby-painted fingernail building one.)

The first issue contained a bicycle radio project that clamped onto the handlebars of your 26" baloon-tire J.C. Higgins. It was a four-tube superhet using the venerable 1R5-3V4 family of battery bottles and a whopping 90V battery, and was a tad bigger than a Star Trek lunchbox. If by chance you hit a curb and were thrown over the handlebars, you were likely to be electrocuited.



There were a number of speaker cabinets and amplifiers for the HiFi freak, and some kit reviews. Further on were a capacity operated relay, a code practice oscillator, and Fun With Neon Lamps. All projects had a schematic diagram plus a pictorial showing every wire and every component connected as though they had been hooked up in mid-air without benefit of a cabinet or chassis. A lot of us built them that way, in fact, by the venerable method of clamping the power transformer in a vise and soldering the whole mess together in a drooping web. And if your B+ lead was pulled against a ground wire by the added weight of another Sprague tubular paper capacitor, well, you opened the vise, swept the whole mess under the workbench, and went on to the next project.



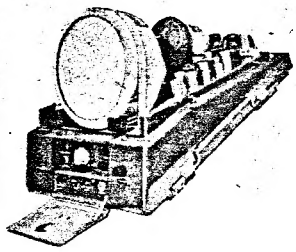
FLASHING LAMPS

AN EXPERIMENTER'S DELIGHT

By EDGAR D. MORGAN

The small radar unit is compact enough to fit into the cockpit of a motor cruiser.

RADAR FOR SMALL BOATS



You could get a CK722 transistor for only $7.95, postpaid. These marvelous little devices had no heater leads, required no 90V batteries, and promised to make computing machines as small as a DeSoto station wagon by the year 2000.

And then there was Carl and Jerry. I mourn for little of my lost youth as I do for that pair of college-age pranksters who spent ten years as Parvoo U. sophomores, scaring the crap out of coeds with light-seeking electronic centipedes. Carl and Jerry were techies with a vengeance, who could solve any problem, social, political, or personal, with a handful of tubes and transistors and a few hours in the basement. They made tornado detectors and crook-catching miniature transmitters and other things that made us all drool. PE would never publish plans for Carl and Jerry's wonders. We were supposed to invent them ourselves. "Nobody ever gave Carl and Jerry the schematics for the things they made," author John T. Frye once said in the letters column. Apparently no one had ever given them to Frye, either. PE eventually outgrew Carl and Jerry. I doubt I ever will.

A NEW COMPANY IS LAUNCHED

For ten years PE was a quaint and corny magazine. We were a quaint and corny society then, too. In those days there was black and white without grey. Religion, sex, and politics did not exist. Only sweating twelve-year-olds in attics and basements, gouging resistors out of old TV chassis and building capacity operated relays that never quite operated. One day late in 1965 I built a 1-tube shortwave radio receiver that did something none of my earlier projects ever did--it worked. Your editor was growing up--as was Popular Electronics. Neither of us has ever been quite the same.----------

IT MAY OR MAY NOT COME IN THE MAIL

-THOUGHTS ON PARTS

Guest Column by Gordon Garb

If you are travelling through the Denver area, and you develop an immediately pressing need for a TIL-139 opto-sensor, chances are that you will not be able to satisfy your need at Radio Shaft Shack. Some other places you might try:

The Electronic Lollipop is located at 5643 N. Broadway (off of Interstate 25 at the 58th St. exit, turn west and then south. The Lollipop is on the right, next to the mattress store.) He is open 10-8 daily, 11-8 Sunday, closed Tuesday. As you walk in, you will notice the front counter with its candy-shop jars filled with variously colored LED's, special chips (8008,FIFO,UART) (Holy Static Zaps! MOS in a Jar! That had better be lead glass--Ed.) and wire wrap boards. His IC's are all prime quality, all are guaranteed and will be tested while you wait if you like. LED's are all tested before sale. Prices are very reasonable, and his stock is good. (What sort of bribe do you suggest to make him move to Chicago?--Ed.) He specializes in semiconductors, but his surplus equipment and parts deserve to be looked over. (Wanna buy one magnetic tape transport spindle, complete with motors and control logic?)(No.--Ed.) A library of data books and tech manuals, along with the Toshibafax machine (Horrors!--Ed.) and his free advice make this place a must for the experimenter. And the lollipops are free! Within the near future (3-6 months) the Lollipop plans to add a mail-order service. Their complete catalog will be over one hundred pages with color interior illos.

Gateway Electronics is on 44th St. just east of Federal Blvd. They are distributors for Altair equipment, so when you walk in you will notice several sets of LED's blinking maliciously at you. They are most likely the friendliest things you will encounter in the store. IC's are not guaranteed, and typically 30 to 90% bad. The people who work there would rather not have to bother taking time away from their own projects to help customers, so don't expect service to be friendly. (They will take your money, albeit grudgingly.) However, if you need a banana jack or a BNC connector, you'll have to get it here, since the Lollipop does not carry plugs and jacks. (How the hell do they make a living? Selling mud pies?--Ed.)

Burnstein and Applebee is an electronics/stereo catalog outfit with outlets in several major shopping centers. Their stock is small, their prices about as bad as Radio Shack, and their sales personnell are not knowledgeable about much more than selling CB's.

Hamilton/Avnet, at 5921 North Broadway, consists of a front door, a counter, a counterperson, and a back room where everything is kept. They are a major component distributor, and do not like to sell to individuals. If you don't know precisely what you want, they won't help you. Unless you buy things in 100+quantities, you will pay manufacturers' suggested retail (A.K.A. ripoff) prices. (In other words, screw 'em!--Ed.)

A short note: If you are in Fort Collins, and you ned a 7473, don't bother trying Mountain States Electronics _____. I went in asking if they had any TTL chips and the guy replied, "No, all we have are IC's." What did he think I meant? Sheep? You'll have to go to Denver for that 7473.------GG---------

/////Thanks, Gordon. And sorry for the interruptions. You know, the more wiseass comments I put in your material, the livelier it probably seemed to me, and the more I enjoyed it. Several people said that the thing they liked most about PyroTechnicswas its humorous outlook. It's my responsibility to give 'em what they want. I'd like to see this sort of thing from a few more of you non-Chicagoans, particularly in the Columbus area, since GT has a generous population out that way too. Takers?

Back to business. A few more endorsements: New Tone Electronics gets a silver star, with a question mark on one point: their catalog lists less than their magazine ads. I can't figure that one out, but it's a crazy world. They have Intel 5101 CMOS RAMs for $4.50, which is the buy of the month, I promise you.

Radio Shack, wonder of wonders, is selling 74C90's for 99 cents. James still charges three bucks apiece. 7490's are often used in dividing down timebases, and the current draw can really mount up with six or eight chips cascaded. Get to the Shack before they realize they're offering an Honest To God Bargain and withdraw it immediately.

Keep the parts data coming in, friends. If you spot any real giveaway bargains, let us know so we can spread the word and cash in on it. Take note if a dealer is selling an item at a cost far below what other dealers are asking. Maybe it's trash but it might be for real. You never know in this business.

—

GT BIODATA

TOM ANDREWS

The following is abstracted from a letter written by a new member. The first paragraph was so good we decided to keep it instead of editing this into a more normal BIODATA.

As you can see from this stationery [headed The Queen Elizabeth, in English and French], I am writing this letter in Montreal. My wife is an abstractor at Chemical Abstracts service and her company has sent her to a conference here. I have used part of my Nestle vacation to tag along as a built-in baby sitter for our nine month old daughter, Angelica Marie. She is definitely a baby techie. When I run the vacuum cleaner at home she lets out a mad scientist kind of laugh, crawls up to it, and hugs it.

I was born in Wilkes-Barre, Pennsylvania and attended grade school, high school, and undergraduate school there. I managed to graduate first in my high school class and to win a four year full tuition scholarship to King's College, a Catholic college run by the Holy Cross Fathers (the same order which has run Notre Dame). I majored in chemistry and managed to graduate with a B.S. (cum laude) and to obtain a Title IV NDEA pre-doctoral fellowship to Case Western Reserve University in Cleveland, Ohio. I was able to satisfy all CWRU requirements for the Ph. D. in chemistry (except for my thesis research of course) during my first two years at CWRU. I wound up in a research group which worked in the field of spectroelectrochemistry. We combined optical and electrochemical techniques in order to study chemical reactions. I always felt unhappy about my initial lack of electronic knowledge but I received little help from my advisor in that area. During my second year at CWRU my advisor took a sabbatical leave to study at the enzyme institute in Wisconsin. When he returned I learned that our entire research group (myself and three postdocs) would have to move to Ohio State although I would maintain academic connections with CWRU.

During my second year at CWRU, I had two roommates who were Ph. D. graduate students in high energy physics and it was their leftover SF books which really got me interested in SF, although I have always enjoyed Heinlein's juvenile books like "Have Spacesuit Will Travel".

I moved to OSU in September of 1971 and married my wife, Gail, in September of 1972. Mr. Nixon cancelled the entire NDEA fellowship program in September of '72. In the early middle of '73 (at the suggestion of my advisor, who did not think I would be able to get enough thesis research done) I decided to leave the academic world, to apply for the CWRU course work M.S. which I had already earned, and to obtain an industrial job as an M.S. chemist.

In July of 73 I obtained a job with the title of Senior Analytical Chemist and Special Projects Chemist, at the Nestle Quality Assurance Laboratory in Marysville, a country suburb of Columbus. We are located in the same building as Westreco, Nestle's only North American Research Facility, and the place where Taster's Choice Freeze Dried Coffee was developed. We often collaborate with research on projects where we can help. We do routine quality assurance work and handle any important problem for which research is not equipped.

I have three major areas of responsibility as well as some minor areas.

My first area of responsibility is all routine and non-routine atomic absorption work. The room which I use for an office is a fully equipped atomic absorption laboratory which is, in my opinion, equal in capability to any other atomic absorption laboratory in the world. Atomic absorption methods use light from a lamp made from an element to determine small amounts of that element in a vapor cloud which is produced by a flame or by an electric furnace. The lamp light is generated either by electron impact on a metal cathode or by excitation of atomic vapor with a 24.8 Megahertz transmitter.

My second area of responsibility involves software support of our laboratory minicomputer system. Our unit uses an advanced version of BASIC (implied LET and E and F format capability) and I write all of the custom programs our lab needs. Our minicomputer system is a Hewlett/Packard 9830A with a 2K memory and the 9871 printer-typewriter with upper and lower case capability. At present our programs are stored and loaded on standard audio cassette tape, but early next year we hope to obtain the 9880B double disc 4.8 Megabyte Mass memory system as well as a 16K memory and some special read-only memory.

My third area of responsibility involves a project called the Nestle Product Register. We hope to totally computerize all records which pertain to the formulations of all products which are made or sold by Nestle or subsidiaries in the United States. I am using the research lab computer, an IBM System 3 with double disk, for the project, and I have written the programs in FORTRAN IV.

My minor areas of responsibility include electrochemistry and fluorescence. I am particularly happy about the way we acquired the bit of electroanalytical we have now. Our lab was involved in a multilab collaborative study and one of the analyses we had to do required a polarograph. I was able to come up with a simple op-amp configuration which, in combination with some other goodies I was able to scrounge or borrow, enabled us to do not only polarography but also cyclic voltammetry and chronoamperometry. (The research facility has a fantastic electronic shop. They assembled the unit according to my instructions.) A unit like that would have cost the company five to ten thousand dollars. Our total cost was seventeen dollars. GO TO P8

NERTZ & BOLTS

LOOKS AT BOOKS

The Jewel in the Skull, The Mad God's Amulet, By Michael Moorcock, DAW Books, $1.25 Paperback, first two of a series of four.

'Way back in 1968, we called this Science-Fantasy, a word I haven't heard in quite a while. It generally means that X number of years in the future, after things have gone boom and settled down a little, the powers-that-be alternate between fragments of forgotten technology and good old fashioned swordfighting. Purer science fantasy than this there cannot be. A thousand years hence, England has gone crazy and is conquering the Continent with ornithopters, lasers, and usually swords. A Hero fights back with swords and whatever else he can get his hands on, including the usual array of crystalline whatchamacallits and inexplicable black boxes. There are monsters, mutants, blood and guts by the kiloliter, fantastic gadgets, long quests, other dimensions, madmen, mystery and lots of deliberately misspelled geographical names (like Amarekh and Turkiya) to keep us guessing where the characters have gotten themselves this chapter. There is so much action in these books that they will probably walk off your bookshelf; put a brick on top of them. But read them first. They are guaranteed to take your mind off of anything that bothers you, for a fast two hours of deliciously improbable escapism. You won't remember the plot ten minutes later, but hell, you can't have everything.

CMOS Cookbook, by Don Lancaster, Sams Books, softcover, $9.95. 414 pages. Four stars, three garters, the golden fleece and an EPROM in a pear tree; if you pass this up you're dead, blind, or both.

I used to make things out of tubes until Steve Johnson pressured me into trying his brand. I cut my teeth on the TTL Cookbook, and ever since then I have been waiting for a CMOS companion work; finally I've got it.

Lancaster is beyond a doubt the most readable of commercial technical writers today. He speaks a tinkerer's language rather than a physicist's, and yet speaks it concisely and expertly. There is never any mistaking what he means. If any book can teach you about integrated circuits, Lancaster's can.

The format is similat to TTLC. Lancaster has expanded the devices catalog, and that is by far the best part of the book. He gives us all essential information, and something manufacturer's data sheets won't tell you: whether the damned thing is any good or not. A few CMOS IC's are definitely not, and the author tells us how and why, and what to use instead. He explains the difference between the A and B series, a matter I had never even heard of.

He has avoided the trap of going over ground well covered in his previous books by assuming that we have already read them. This might have bothered me in some cases, but not here: if you haven't read Lancaster's other books you're a fool and you know it. This leaves him plenty of room for new material, of which there is plenty. I was intrigued by Mickey Mouse Logic (MML) in which you add diodes and resistors to existing and handy logic packages to make them do other things.

The discussion of the 4046 CMOS PLL is thorough and fascinating; it makes you itch to use it in something, anything. Lancaster also describes a number of CMOS LSI devices, such as a one-chip frequency counter, television numeric display, and teeny-weeny wristwatch chip. These would be handy if you knew where to get them.

Describing the book does it little justice. Pick it up and read it; it'll do you good. Lancaster evidently feels the joy of tinkering very strongly; he is a man who should be listened to. Naturally the Sams price is outrageous for any paperback, but I have a hunch I'd buy Lancaster at any price. Sams probably knows that, dammit. Oh well.

DOME SWEET DOME

BY GEORGE EWING WA8WTE

In the face of tremendous clamoring for information about do-it-yourself geodesic structures (no one has yet told me to stop or they'll cram poisoned triscuits down my beer-input orifice)(I had to make that threat to get him to start--Ed.) I will begin a very basic introduction to domebuilding, aimed at the practical tinkerer, rather than the software smartass who already knows it because he taught Bucky Fuller all he knows back in '52.

Why domes? They are the simplest answer to the need for lightweight structures that will roof over a given area free of internal supports with utmost economy of materials.

Why geodesic domes? The faceted polyhedral style dome allows the builder to approximate the strength and elegance of curved structures with straight, flat materials. Ferrocement, foam, and air-support domes have their advantages too, and will be discussed as well.

If you give a ratrump about all this, try and get a copy of Domebook and Domebook II from: (if they're still in business)
Pacific Domes Box 219
Bolinas, CA 94924

This is a splinter group from the people who did the Whole Earth Catalog things, and is printed in the same Guerilla Funk style.

Don't be put off by the eco-nut/drug fringe rhetoric and horrendous spelling. Some of these people are no doubt flaky as a mud fence (or were in 1970) but the spherical trig tables and t'other snivvies are accurate, and these people have beaucoup practical experience.

If you can't get a copy, try college libraries, and photocopy relevant pages on one of those things Jeff plays with.

All right. Geodesic structures are made by taking any of the regular Platonic solids, such as a dodecahedron or icosahedron, and subdividing the facets into smaller triangles, diamonds, etc. to more nearly approximate a sphere.

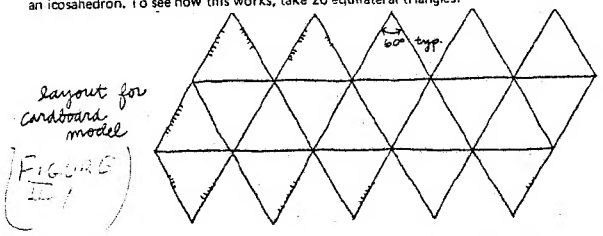
Take twenty equilateral triangles of cardboard, circuit board, or neutronium-plated plexiglass, and glue them together edge to edge. Or lay them out on a sheet of some solid material and then score and bend it until you get a solid thing that looks like a 3-D emblem for the Chrysler Corp. This is an icosahedron. To develop a dome from this geometry, you simply subdivide the twenty basic triangles into smaller ones. There are two basic ways to do this: Alternate Division (fig. 2) and Triacon (fig. 3) (Remember Triacon? That was the convention where Harlan Ellison told the fans how he beat the hell out of Frank Sinatra's bodyguard.)

The number of times a given triangle's edge is subdivided is called its frequency. (fig. 4)

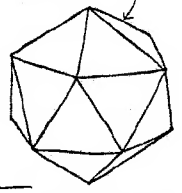
THE SOCCER BALL

The first dome structure to be discussed here is a 3-frequency alternate breakdown, vertex-zenith, icosahedral-generated 5/8 spheroid solid called the "SunDome" from a Popular Mechanics swimming pool cover designed by Fuller in the Fifties. It is Square One, the Heath Two'er or Piper Cub of geodesics. Far and away more of these damned things have been built than all the other myriad geometries combined. A complete spherical version is a soccer ball. (Which is about the biggest geodesic my backyard can hold. Oh, you wilderness types!--Ed.)

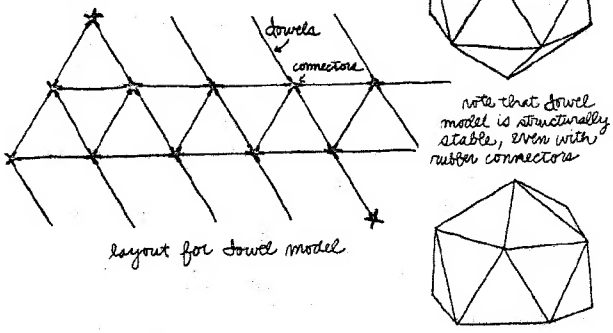
Geodesic domes are the invention of R. Buckminster Fuller. Domes can be generated from many different shapes; the ones we've built so far are derived from an icosahedron. To see how this works, take 20 equilateral triangles:



join them together, five triangles around each vertex to make an icosahedron (*vertex* is where triangle tips meet).



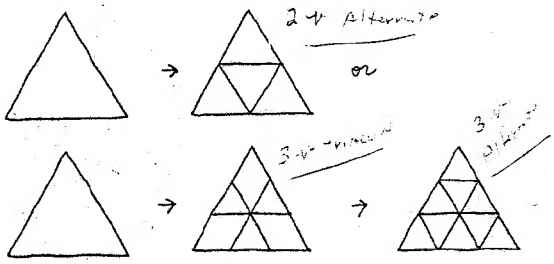
If you make this with dowels and rubber connectors, here is how to lay out connectors before joining all together



You can make a structure by removing the bottom five triangles (see p. 98) and placing it on the ground. It sits flat. When you remove the triangles it becomes unstable, but once the structure is connected to the earth it is again solid.

You can make small structures of icosahedrons, but if you begin to make larger structures, the fifteen triangles get large, heavy and you begin to need big timbers for struts.

Fuller has subdivided the large triangles of the icosahedron to make smaller triangles:



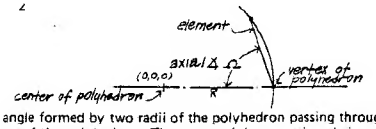
I am including a template with this article, so Jeff can repro it on a sheet of paper and include it with the next Pyro. If he does, you can make five of them on cardboard, fasten the edges together, and have a nice model dome about a foot in diameter at the equator. If you leave out a couple of the 103 triangles near the rim for your nose, you can wear it as a space helmet at the next con, or give it to your little brother so he can play GI Joe vs. King Zor. (Sorry, George. Old Zor has retired and now bags groceries at the IGA in DuBuque. Sigh. --Ed.)

I lived for a year in a 22 foot sundome made out of 2X2 wood struts with an eighth inch Masonite skin. It supported severe snow loads, fifty mile antenna winds, and attacks by Snodgrilla and Rodan. (Not to mention those lovable Nocturnal Styrofoam Crunchers--do tell us about them sometime.--Ed.) It stayed comfortable at thirty below with only one inch styrofoam insulation and a small oil heater or fireplace running. It survived WA8WTE, WA8YNP, and WN8QVV drinking 740ml cans of Fosters' and doing King Kong imitations on the pentagonal skylight. (Combined mass >700 lbs.)

Jargon: Struts: sticks, poles, etc. that form the edges of the triangles, diamonds, or whatever of a geodesic solid. Those playground jungle gym things are all struts. Membrane: Skin. The faces of the triangles and diamonds. Sheet metal, cardboard, and soccer balls are all strutless membrane. (I think my third grade teacher, Sister Agoraphobia, called me a strutless membrane once. She was always ahead of her time...--Ed.)

Elliptical domes can be generated by altering the chord factors during calculations, resulting in structures which, unlike the Soccer Ball, are not portions of a sphere. Slang terms include: ZTOZ: Prolate spheroid, semimajor axis truncation. (Half an egg split lengthwise) ZAFU: (Gezundtheit--Ed.) Oblate spheroid, semimajor axis truncation. Zapoche: Prolate spheroid, diagonal truncation, etc. Hub: The device(s) for fastening devices together at vertices.

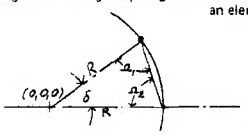
TO BE CONTINUED!!



Central angle (delta δ) = an angle formed by two radii of the polyhedron passing through the end points of an element of the polyhedron. The vertex of the central angle is chosen as that point common to both radii (the center of the polyhedron).

The central angle δ may be found by knowing the axial angles Ω_1 & Ω_2 at each end of an element.

$\delta = 180 - (\Omega_1 + \Omega_2)$



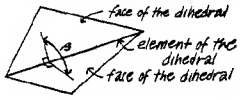
Chord factor (cf) = the element lengths calculated based on a radius of a non-dimensional unit of one for the spherical form with the end points of the elements coincident with the surface of the sphere.

If the central angle δ is known the chord factor may be calculated as follows: $cf = 2 \sin\frac{\delta}{2}$

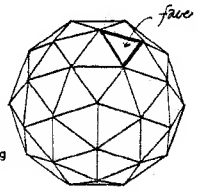
The length of any element for larger structures may be found by the equation: $l = cf \times r$

where: r = the radius of the desired structural form
l = the length of the new element

Dihedral angle (beta β) = an angle formed by two planes meeting in a common line. The two planes themselves are faces of the dihedral angle, and the element is the common line. To measure the dihedral angle measure the angle whose vertex is on the element of the dihedral angle and whose sides are perpendicular to the element and lie one in each face of the dihedral angle.

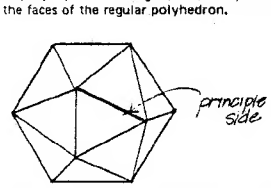


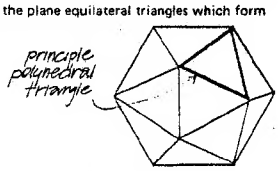
Face angle (alpha α) = an angle formed by two elements meeting in a common point and lying in a plane that is one of the faces of the polyhedron.



Face = any of the plane polygons making up the surface of the structural form.

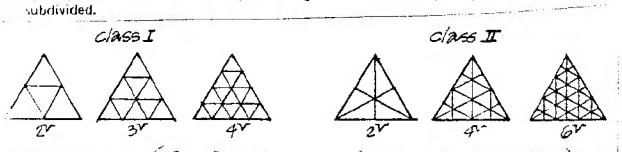
Principle polyhedral triangle (PPT) = any one of the plane equilateral triangles which form the faces of the regular polyhedron.





Principle side (PS) = any one of the sides of the principle polyhedral triangle.

Frequency (Nu ν) = the number of parts or segments into which a principle side is subdivided.



ALTERNATE (Fig 2) TRIACON (Fig 3) 106

THE COMPUTER FOR PEOPLE WHO HATE COMPUTERS

Hey, you computer haters, have I got the gadget for you!

It's an infinitely programmable timer. It's an infinitely programmable electronic music producer. It's a variable speed morse code keyer. It's all thi s and a helluva lot more, and costs only thirty bucks. Yeah, maybe it can be a computer too, but it doesn't have to be. It'll do damned near anything you want it to do.

RCA's CDP1802 is a microprocessor chip using CMOS technology. It is the fastest non-bipolar processor chip around, beating even the mighty Zilog by 2 whole megahertz. Maybe you don't care about that. Maybe you only care about how much the thing is gonna cost you, how hard it is to put together, and how much doing it takes to make it do anything interesting. Let me give you some facts, based on my own experience.

Cost. The chip goes for thirty bucks. It needs perhaps five or six CMOS chips to support it. These are general 4000 series cheapies that will amount to a couple of bucks at most. Ten bucks worth of toggle switches. At least two memory chips. If you act fast, you can get them from Poly Paks at 2 for $3.51. A better deal is in CMOS memory chips; a pair of these can be had for nine bucks. You'll need some sort of hexadecimal readout. A pair of TIL311 hex latch-driver-display chips sell for 16 bucks in the magazines; Steve and I found them for a buck apiece at the Wheaton hamfest. You can rig a hex display with 7448's and any 7-segment LED display. The hex characters don't look like ABCDEF, but they are unique and you can memorize them. It beats a line of discrete LED's any day. Add your odds 'n ends, diodes, resistors, etc. and you should come out a tad ahead of fifty bucks. Which isn't bad for what it can do.

In case you aren't up on all the microprocessor buzzwords, I'll try and describe it in non-computer terms. The CDP 1802 is a programmable switch. You attach it to a pair of memory ICs. You store instructions in those memory chips in coded form, as pairs of numbers. Each pair of numbers tells the 1802 to do a certain something. It can test inputs for being at supply voltage or ground, and switch outputs accordingly. It can execute complex timing loops stored in memory, switching merrily as it goes.

You store the instructions in memory as eight on/off voltage states. Each set of eight such states is called a byte. You store a byte in memory by flipping a line of eight toggle switches. "On" is usually written as "1". "Off" is written as "0". The instruction 72 is set into the toggle switches as 0 1 1 1 0 0 1 0. You get the switches set right, push a button, and that instruction is set in memory. You line up the next one, push the button, and so on. You can store 256 instructions in the two basic memory chips. More memory can be added in 256 byte increments.

Once you get all your instructions stored in the memory chips, you start the computer running. It will begin at the first instruction and step through them one by one until the last, obediently following the instructions all the way. Suppose your first instruction turns an output line on. The second instruction delays for 2 microseconds. The third instruction turns the output line off. The fourth instruction tells the device to return to the beginning and start over. It will loop through this sequence until you turn it off, generating a square wave with only four instructions.

Not impressed? Well, thirty five or forty instructions will give you a morse code keyer, with controllable keying characteristics. Eighteen instructions will give you an audio sweep generator. The better you get at lining up instructions, the more things this intriguing gadget will be able to do. You can go on adding memory almost indefinitely, up to 65,000 bytes. But since that's about 250 memory chips, you needn't worry about running out of room. You'll run out of money a lot sooner.

The point of all this is that microprocessors do not have to be huge, complex, expensive systems. You don't need full keyboards or complex languages or tape drives. You don't need an 18 amp power supply. Mine uses just a touch over 175 milliamps. You certainly don't have to do any of what we would call "computing." Leave that to the software boys in their ivory towers, babbling in their own language. Down here us hardware types have work to do, and nothing can do it quite as well as a microprocessor. Look into it. Get hold of Popular Electronics for August-September 1976 and March 1977. Read the COSMAC Elf series. The author seems to think the thing is a computer. But it's just a switch, man. Even if it can add.

You wouldn't hold that against me, would you?

NETWORKING IT

BY MIKE O'BRIEN

It should be obvious by this time that the most fruitful periods of technology are those of synthesis, where two fields are combined for the benefit of both. It's our good fortune to be around during one such period, and our better good fortune to be able to do this ourselves, under the disguise of a hobby.

So far in this newsletter we've been discussing whole bunches of things, but most items can be grouped under the classification of electronics and computers. Most of the electronics has been ham-oriented stuff. Well, the world of amateur radio has been in the process, the last few years, of discovering the world of microprocessors. Most hams have limited themselves to using microprocessors for what they were designed to do, that is, control the operation of their station.

Of course, this isn't by any means the only use of microprocessors. The home computer crowd is proof enough of that. One proceeds to wonder, in a dreamy sort of way, whether general-purpose computing and amateur radio might possibly have anything to say to one another. One proceeds to sit up straighter and say, "They sure do!" There is an old beast with a new name in the computer field, called "distributed processing". He has a close relative named "networking". In distributed processing, you pretend that central processing units are allocatable resources, just like terminals, disks, and tapes. Then, when programs are written, they take advantage of the multiplicity of processors to do several parts of the job concurrently. Whoop-de-do. But in networking, you don't go quite that far. You acknowledge the existence of other machines out there somewhere, which you can talk to and transfer files to and from, but you run our own local world all by yourself. If certain systems enter or leave the net, it's all OK by you. You can pass messages, programs, mail and data back and forth through the net, just as you handle traffic in an amateur radio net. Messages are a little more structured than in normal amateur netting, because the message to be transmitted may be broken up into packets for ease of handling.

I think you probably begin to see the connection. If it were only possible to convince the FCC of the experimental nature of amateur radio (a minor matter which they appear to have forgotten of late), one could proceed to allow computers to communicate over the air. In fact, one could allow computers to enter a network environment over the air. It would be likely that in order to provide relatively error-free operation, one would use the higher bands in a city, for a city-wide computer network. This works fine in areas of high population density. It also allows for a very high bandwidth, which allows more information to be crammed down the line in a shorter period of time. This is important not only for speed considerations, but for error considerations as well. At high speeds you can include more redundant information; this may allow you (depending on the error-correction scheme you're using) to avoid asking for a repeat message. There are schemes that allow you to reconstruct the missing parts of a garbled message.

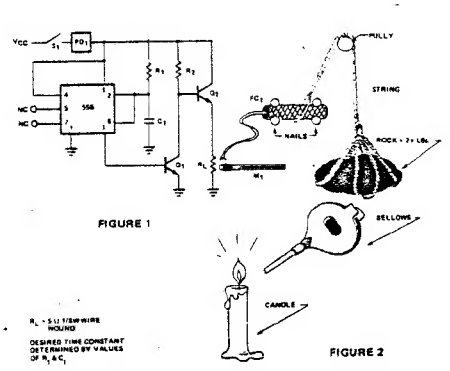
Then you can go farther. You could arrange for a nationwide net to appear on the lower bands once a week or so, running a narrower bandwidth network (and hence a slower one) to pass information back and forth between the smaller nets. And there's no reason for individuals not to have their own private network schedules, for system development and intercity "trek" tournaments, whenever they wish. Eventually one could foresee part of some lower band being set aside as the "network channel", where the network lives all the time, with individual systems sliding in and out of the net at will. All of the hard parts of this have been worked out in the systems domain already, and it's all in the public domain. The ARPANET is a system just like this, that runs over dedicated phone lines.

Don't you think it's about time the little guy got a piece of the action?

ODD BODKINS

LIFTED FROM HERE & THERE

SCHEMATIC DIAGRAM OF DELAYED LIGHT TURN-OFF



Circuit courtesy of Signetics Timers catalog.

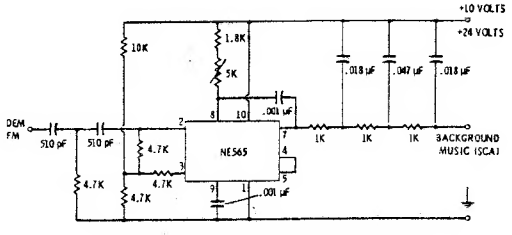
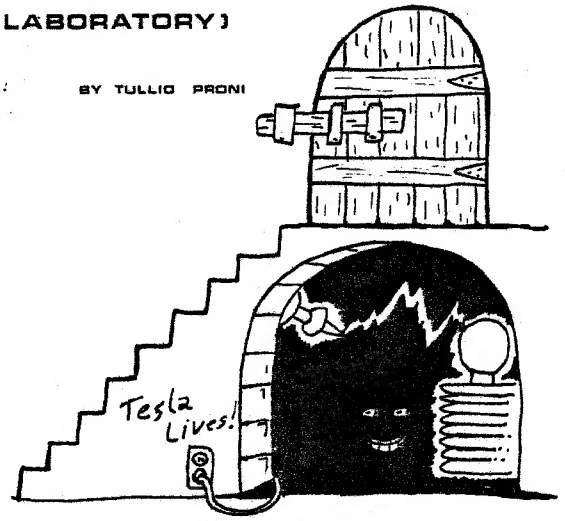


Fig. 6-27. An SCA demodulator using an NE565.

NOTES FROM THE UNDERGROUND (LABORATORY)

BY TULLIO PRONI



Greetings, fellow FFFOD's (Fabricators of Far From Ordinary Devices.) The time has come to shed a little light on (and through) a wondrous substance given to us by modern science--plastic. More specifically, I will reveal the secrets of working with Plexiglass and show what you can do and not do with the stuff in your home.

First you should realize that Plexiglass is just a brand name for an acrylic plastic. Acrylic plastics are hard, easy to glue and machine, and can be buffed to a high gloss. Plexiglass is fairly easy to get, with most major cities having dealerships. The dealers will, for a small fee, cut your Plexiglass for you, which can be quite an advantage. Remember, however, that any brand of acrylic works equally well. These factors allow you, with relitively little equipment, to turn out professional looking gadgets. After all, aren't you tired of using miniboxes for all your projects? How about building your own box?

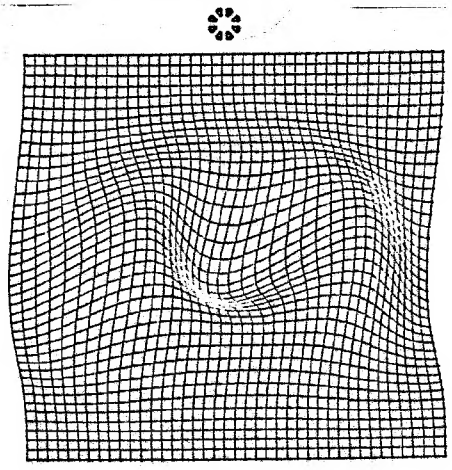
To start with you should first visit your plastics dealer. This is a critical step in that you must know what he has before you know what you can build. Ask for a catalog or price list of what he has. Let me warn you in advance that plastic is not cheap. (Which is why should always look out for cuttings and chunks at hamfests!!--Ed.) You now buy enough plastic for your project, some buffing compound, and a can of solvent. Plexiglass can be glued using epoxe, etc. Solvent, though, works a good deal better. If you have access to chemicals use dichlorethane, if not just use what the dealer has. At this point you could have the dealer cut the plastic, or you could do it yourself. If you d your own cutting a table, band, or jigsaw would be handy but even a hacksaw will do. In any case before cutting carefully mark your pattern on the Plexiglass with a scribe or, if it has protective paper on it, with a pencil. Now cut it close to your lines but not over them--it is always easier to cut off more plastic than to try and stick it back on. After cutting, file the edges so that they are as straight as possible. An easy way of doing this is to sandwich the Plexiglass between two pieces of sheet metal with straight sides and put the combination in a vice before filing.

Next sand the Plexiglass using fine and extra fine sandpaper. You can then use a buffing wheel or you can hand buff the edges. If you use a buffer mounted on a drill motor be very careful and if possible clampn the drill in a vice. This takes practice so try it on some scraps first. There is another way. If you have a propane torch adjust it for a small hot flame and run the flame quickly over the sanded edge. If you overheat the plastic it will bubble and burn. The plastic may also get soft and bend so practice!

Ok, one way or another you now have straight, polished edges which look as good as the flat surface of the plexiglass. Now find a flat, clean surface (glass is ideal) and place the bottom part of the box on it. Now put the sides in position and using a minimum of solvent put the sides into place. The solvent dries quickly so if you wish to make corrections in the positions of the sides do so at once. The solvent can ruin the finish so it should be applied carefully, with a hypodermic if you can get it.

The time has come to put a lid on your box. If you were careful enough you might be able to press-fit the top of the box in place but normally ,ou would prefer to screw it on. For this you will need a tap (4-40 or 6-32) and a drill. If you have never used a tap before let me assure you that they are easy to use and fairly cheap-- just go slowly and use oil. Usually you will not want to tap into the sides directly (unless they are 1/4" thick or greater) so you should buy some small blocks (1/2"X1/2"X1/2") or make them by gluing pieces of Plexiglas s together. These blocks should be placed in the corners of the box near its top and glued in place using solvent. Now replace the lid and drill through it so that you also drill through the blocks. You can now tap the holes and enlarge the holes in the lid so that the mounting screws will pass easily through. At this point you can drill any other holes you may need and mount your components. At last--you're done!

You're probably also asking yourself if it was worth it. That's one question you will have to answer for yourself but at least you have a box the size and shape you want. You also have an idea why some GT products cost so much. To give you an even better idea, in the next issue I will discuss machining plexiglass. But for now CIAO



CONT. FROM PAGE 5

I began attending the local area cons (Marcon and Midwestcon) in '75 and was attracted to General Technics by Tullio's LED powered ray-guns [Another case of scrounge. They use Christmas tree lights, not LED's. -- MOB]. I felt that the group is perhaps a bit top heavy in electronics and that it might benefit from the input of a chemist.

Like many other techies, my activities are limited by economics, but I won't let lack of money take my dreams away.

I am at present working on what I hope will become a novel entitled The Teddy Bears of Color Talk. Just as Tolkien developed The Lord of the Rings around a language so also will this story be developed. The language of the teddy bears makes illiteracy impossible and forces rapid development of technology.

THE MOB

Dave Anderson
555 Clover Lane Boulder CO 80303

Tom Andrews (614) 486-0877
2300 Brandon Rd. Columbus Ohio 43221

Paul Baumann
920 Elmwood Evanston IL 60202

Mike Bentley
904 W. Green St. #612 Urbana IL 61801

Mike Blake (312) 486-3216
2125 W. Homer St. Chicago IL

Dave Corner (312) 338-6173
1666 W. Pratt Chicago IL 60626

Thomas Devlin
1860 Rochester Royal Oak MI 48073

Al Duester (616) 335-9456
1604 Ottowa Beach Rd. Holland MI 49423

Jeff Duntemann (312) 764-5069
Carol Duntemann
6424 North Albany Ave. Chicago IL 60645

Alex Ellingser (312) 743-6669
2091 W. Estes Chicago IL 60645

Mark Evans
365 E. 15th Avenue Columbus Ohio 43201

George Ewing (616) 627-6587
Box 502 Cheboygan MI 49721

Gus Flassig (312) 262-0559
Kathy Echterling Flassig
6757 N. Sheridan Rd. Chicago IL 60626

Jim Fuerstenberg (312) 446-9120
624 Elder Ln. Winnetka IL 60093

Lance J. Ferraro
USS Pensacola (LSD 38)
R Division FPO New York 09501

Gordon Garb
Box 1866 Ft. Collins CO 80522

Kenneth Goltz
2861 South 33rd St. Milwaukee WI 53215

Bob Halloran (614) 421-1252
134 W. 9th Avenue Apt. D Columbus OH 43201

David S. Hoornstra (313) 994-0784
366 Cloverdale Ann Arbor, MI 48105

Mark Hyde
Rm 107 E. Holmes Hall
Michigan State Univ. E. Lansing MI 48824

Alice Insley (312) 334-3216
2425 W. Wilson Chicago IL 60625

Steve Johnson (312) 777-3407
3109 N. Kilpatrick Chicago IL 60641

Todd Johnson
231 WCH Michigan Tech Houghton MI 49931

Clyde R. Jones (312) 244-3875
Box 1099 Waukegan IL 60085

Ben Kuehlhorn (312) 736-2877
4819 North Keystone Chicago IL 60630

David E. Lusch (312) 249-0514
1656 McKay Waukegan IL 60085

Marcy Lyn
710 W. Mill Carbondale IL 62901

Mike Mahaffey (915) 698-9678
118 Colorado Dyess AFB Texas 79607

Marco Mendez (312) 472-9818
3744 N. Southport Chicago IL 60613

Mike O'Brien (312) 761-4989
Sarah Shaw
1642 W. Morse #1S Chicago IL 60626

Chuck Ott (312) 288-5799
2439 Logan Blvd. Apt 2H Chicago IL 60647

Doug Price (312) 234-8619
715 E. Morningside Dr. Lake Forest IL 60045

Tullio Proni (616) 342-4967
1309 Wells Pl. Kalamazoo MI 49001

Sarah Prince
8030 Sawmill Rd. Dublin Ohio 43017

Steve Reubart (614) 297-1270
408 E. 13th Ave. Apt. B Columbus Ohio 43201

Kurt Sakaeda (312) KE 9 0910
4933 North Ridgeway Chicago IL 60625

John Singleton
5853 Houston Rd. West Lafayette IN 47906

Rod Smith
922 Belvoir Dr. Frankfort KY 40601

John Stanley
607 9th St. E. #2 Minneapolis MN 55404

Frank Stodolka
Box 456 Minneapolis MN 55440

Jeff Tolliver
305A E. 19th Ave. Columbus Ohio 43201